

New York City, 54, nw., 2d.

Fort Macon, North Carolina, 51, sw., 21st.

Chincoteague, Virginia, 51, nw., 2d.

#### LOCAL STORMS AND TORNADES.

Vevay, Switzerland county, Indiana: a heavy thunder-storm, attended by a violent gale moving from south to north-east, occurred from 5.30 to 6.10 p. m. of the 20th. Houses were unroofed, the top stories of substantial brick buildings carried away, and chimneys, trees, fences, etc., prostrated within a path six hundred feet in width; heavy rain and light hail accompanied the storm. After passing over this place no other damage was done until the storm reached Bethel Church, six miles northeast of this station, where it carried away the roof and rafters of the church and deposited them two hundred feet away.

Savannah, Georgia: two tornadoes occurred in this vicinity about 4 p. m. of the 20th; one in Ware county, near Waycross, which moved from southwest to northeast, with a track about two hundred yards wide, and the other in the northern part of Chatham county. No great damage was done by either, as their tracks were through a pine wood country.

Helena, Phillips county, Arkansas: a tornado occurred about 4.30 p. m. of the 29th, doing considerable damage in this city. The direction of movement was from west to east. West of the hills, which act as a barrier to the city, it was more violent, blowing down houses and rendering some of the roads impassable by the fallen trees. The loss is estimated at about \$10,000.

Grove Hill, Clarke county, Alabama: a tornado passed near this place on the 27th, doing considerable damage to timber and fencing. The storm came from the west and its track was one-fourth of a mile wide.

Smith's Station, Lee county, Alabama: a tornado passed over this section during the storm of the 29th and 30th, doing much damage to property in its track, the width of which was about one hundred yards; the storm moved from the southwest. Some small buildings were destroyed, fences blown down, and several persons slightly injured.

The following are accounts of tornadoes which occurred during March, 1886, forwarded by special tornado observers:

Belmore, Putnam county, Ohio: a tornado occurred at 8.30 p. m. of the 20th, passing from southwest to northeast; one church was badly damaged.

Williamsport, Allen county, Indiana: a severe storm, probably a tornado, occurred at 5.30 p. m. of the 20th, destroying two churches, several barns, and killing a few cattle.

Several tornadoes are reported to have occurred on the afternoon of the 29th in Georgia. In Bullock county, a church was destroyed, four persons were killed and ten badly injured; at LaGrange, Troup county, several old buildings were thrown down; near Palmetto, Campbell county, one house was destroyed and three persons fatally injured.

#### NAVIGATION.

##### STAGE OF WATER IN RIVERS.

The Mississippi River reached its highest stage during the month at all stations north of Cairo, Illinois, from the 28th to 31st. At Keokuk, Iowa, it passed the danger-line on the 30th, and at the close of the month was .3 of a foot above this point; navigation was practically resumed at all points between Keokuk, Iowa, and Saint Paul, Minnesota, from the 16th to 28th. At Cairo a gradual rise set in on the 23d, and on the 31st the water was within .9 of a foot of the danger-line, and continued rising.

The Ohio River at Pittsburg, Pennsylvania, which had been rising slowly since the 12th, reached its highest stage, 14.1 feet, on the morning of the 23d, after which the water began to recede.

The Tennessee River at Knoxville, Tennessee, was remarkably low on the 17th, the gauge showing but 1.2 feet, and on the 19th the water was two inches lower. A decided rise set in on the 28th, and at 2 p. m. of the 31st had reached a height of 29.5 feet, a rise of 18.7 feet in the preceeding twenty-four hours.

In the following table are shown the danger-points at the

various river stations; the highest and lowest depths for March, 1886, with the dates of occurrence, and the monthly ranges:

*Heights of rivers above low-water mark, March, 1886.*

[Expressed in feet and tenths.]

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, Louisiana.....	29.9	28	17.6	1, 2	13.0	4.6
<i>Arkansas River:</i>						
Fort Smith, Arkansas.....	22.0	11	9.2	29	4.7	4.5
Little Rock, Arkansas.....	23.0	14	10.1	28, 29	6.1	4.0
<i>Missouri River:</i>						
Yankton, Dakota.....	24.0	18	14.1	31	10.0	4.1
Omaha, Nebraska.....	18.0	29	9.4	17	8.0	1.4
Leavenworth, Kansas.....	20.0	26	14.9	12, 13, 14	7.6	7.3
<i>Mississippi River:</i>						
Saint Paul, Minnesota.....	14.5	29, 31	8.2	25	6.0	2.2
La Crosse, Wisconsin.....	24.0	31	7.7	22	5.8	1.9
Dubuque, Iowa.....	16.0					
Davenport, Iowa.....	15.0	28	9.7	20	7.8	1.9
Keokuk, Iowa.....	14.0	31	14.3	17	6.1	8.2
Saint Louis, Missouri.....	32.0	30	23.2	15, 17, 18	14.9	8.3
Cairo, Illinois.....	40.0	31	39.1	19, 20	20.4	18.7
Memphis, Tennessee.....	34.0	1	28.0	23	14.4	14.2
Vicksburg, Mississippi.....	41.0	6	39.0	26	24.2	14.8
New Orleans, Louisiana.....	13.0	9, 12	13.1	31	9.6	3.5
<i>Ohio River:</i>						
Pittsburg, Pennsylvania.....	22.0	23	14.1	11	2.9	11.2
Cincinnati, Ohio.....	50.0	31	40.4	14	12.3	28.1
Louisville, Kentucky.....	25.0	31	14.9	15	6.1	8.8
<i>Cumberland River:</i>						
Nashville, Tennessee.....	40.0	31	33.2	15	6.5	31.7
<i>Tennessee River:</i>						
Knoxville, Tennessee.....	31	29, 6	19	1.1	29.5	
Chattanooga, Tennessee.....	33.0	31	43.0	12, 20	5.0	38.0
<i>Monongahela River:</i>						
Pittsburg, Pennsylvania.....	29.0	23	14.1	11	2.9	11.2
<i>Savannah River:</i>						
Augusta, Georgia.....	32.0	31	30.8	20	7.8	23.0
<i>Mobile River:</i>						
Mobile, Alabama.....	28	18.2	2	15.6	2.6	
<i>Sacramento River:</i>						
Red Bluff, California.....	10	3.6	29, 30, 31	2.7	0.9	
Sacramento, California.....	6	19.5	31	17.5	2.0	
<i>Willamette River:</i>						
Portland, Oregon.....	24	8.7	3, 4, 5	3.0	5.7	
<i>Colorado River:</i>						
Yuma, Arizona.....	6	18.3	1	15.3	3.0	

\* Observations interrupted by ice; see text.

#### ICE IN RIVERS AND HARBORS.

*Mississippi River.*—Saint Paul, Minnesota: the ice dam below Robert street bridge broke at 2.30 p. m. of the 25th, and passed out without doing damage. Owing to the many obstructions in the river above the bridge the dam remained intact until the 31st, on which date it moved a short distance.

Red Wing, Goodhue county, Minnesota: river opened and ice ran out on 25th.

La Crosse, Wisconsin: river frozen from the 1st to 21st; river clear of ice along the Wisconsin shore, and extending one quarter of the distance across, from the 22d to 26th; heavy floating ice on the 27th; river clear of ice and navigation opened on the 28th; the steamer "Percy Swain," the first boat of the season, arrived on the 29th.

Muscataine, Muscatine county, Iowa: the ice in the river broke and ran out on the 18th; the first steamboat of the season arrived on the 29th.

Davenport, Iowa: river frozen, 1st to 18th; river open on the 19th; the steamer "Wes Rambo" arrived and departed on the 22d, opening navigation for the season.

Keokuk, Iowa: the ice dam in the river on the 4th extended from three miles north of this city to Quincy, Illinois; the ice commenced to break on the 14th, and on the 15th the channel was clear from this point to Saint Louis. The Warsaw packet "Patience" resumed her regular trips on the 16th, opening navigation for the season.

Saint Louis, Missouri: floating ice, 4th to 10th.

*Missouri River.*—Yankton, Dakota: the ice in the river broke and passed out during the night of the 17th, but gorged at Elk Point on the 20th.

Omaha, Nebraska: the ice in the river began to move on the 15th; river open, 17th.

Leavenworth, Kansas: floating ice in river, 1st to 6th.

*Platte River.*—Yutan, Saunders county, Nebraska: ice broke on the 18th; river clear of ice, 22d.

*Cedar River.*—Cedar Rapids, Linn county, Iowa: river clear of ice on the 22d.

*Ohio River.*—Pittsburg, Pennsylvania: floating ice, 1st to 8th, 11th.

*Red River of the North.*—Grand Forks, Grand Forks county, Dakota: the ice in the river was two feet thick and not broken at the end of the mouth.

*Saint Vincent, Minnesota:* river frozen throughout the month.

*Lake Superior.*—Duluth, Minnesota: lake frozen throughout the month.

*Milwaukee River.*—Milwaukee, Wisconsin: the ice in the lower portion of the river broke and moved out on the 17th, and in the upper portion on the 20th.

*Lake Michigan.*—Chicago, Illinois: ice broke and floated out of the harbor on the 12th. Captain Rogers, of the propeller "A. B. Taylor," which arrived from Saugatuck, Michigan, on the 20th, states that navigation is open as far as the upper part of the lake is concerned; this is the first arrival of the season.

*Saint Clair River.*—Port Huron, Michigan: floating ice in the river, 15th, 16th, 19th, 21st to 30th; the steamer "Mary" resumed her regular trips between this city and Saint Clair on the 16th; the steam barge "Atlantic" arrived from Detroit on the 28th, and departed for points up the lake, being the first departure north for the season; 300,000 feet of logs were torn from their moorings on Sarnia Bay by ice on the 31st, and were carried down the river.

*Detroit River.*—Detroit, Michigan: floating ice in river, 1st to 11th, 12th, 13th, 14th, 16th, 19th, 21st to 25th, 28th. The steamer "Riverside" arrived from Amherstburg, Province of Ontario, on the 15th, being the first arrival of the season.

*Grand River.*—Grand Haven, Michigan: but little ice remained in the river on the 4th. Lake Michigan was entirely free of ice at this point on the 12th, and the Milwaukee boats were making their regular daily trips.

*Lausling, Ingham county, Michigan:* river was clear of ice on the 19th.

*Maumee River.*—Toledo, Ohio: ice began moving on the 14th, and on the 19th the river was clear of ice.

*Sandusky River.*—Tiffin, Seneca county, Ohio: river partially filled with slush ice on the 7th, 11th.

*Sandusky Bay.*—Sandusky, Ohio: ice in the bay broke and began moving out on the 16th; bay entirely clear of ice on 21st; navigation resumed on 31st.

*Lake Erie.*—Cleveland, Ohio: the steamer "City of Detroit," from Detroit, arrived on the 25th, being the first arrival of the season.

*Presque Isle Bay.*—Erie, Pennsylvania: the bay was clear of ice on the 26th.

*Niagara River.*—Buffalo, New York: river open on the 24th.

*Oswego River.*—Oswego, New York: river and mouth of harbor was free of ice on the 26th.

*Hudson River.*—Troy, Rensselaer county, New York: the ice in the river in front of the city began to move out on the 23d, but the gorge at Pleasant Island remained firm.

*Albany, New York:* river frozen from the 1st to 25th; the ice broke during the morning of the 26th and slowly moved out. The steamer "Lotta" left for New Baltimore, Greene county, on the 27th, and returned on the 29th, opening navigation for the season.

*Poughkeepsie, Dutchess county, New York:* the steamer "John L. Hasbrouck" arrived on the 12th from New York City, opening navigation for the season.

*New York City:* navigation was greatly interfered with by ice on the 2d, 3d, 5th, and 6th. The river was again closed by ice on the 2d; at Tarrytown it was nearly frozen across, and entirely frozen at Peekskill. Below Tarrytown the tide broke the ice and piled it high along the shore, the channel being full of floating ice-blocks, rendering it impossible for steamers to break their way through.

*Mount Hope Bay.*—Fall River, Bristol county, Massachu-

setts: the port was entirely closed to navigation by ice from the 2d to 5th for steamers, and to the 9th for sailing vessels.

*Lake Whitney.*—New Haven, Connecticut: lake clear of ice on the 19th.

*Sandy Hook Bay.*—Sandy Hook, New Jersey: floating ice in the bay on the 3d, 4th, 5th, and 6th.

*Chincoteague Bay.*—Chincoteague, Virginia: bay frozen on the 2d, causing the suspension of navigation.

*Chesapeake Bay.*—Baltimore, Maryland: considerable ice was reported in the bay from Sandy Point to Seven-foot Knoll on the 2d.

*Miscellaneous.*—Mr. Wm. G. Yetter, voluntary observer at Catawissa, Columbia county, Pennsylvania, reports that the north branch of the Susquehanna River was closed by ice on morning of the 2d, but opened during the afternoon of the 3d. Navigation on the north branch of the Pennsylvania Canal was resumed on the 29th.

#### FLOODS.

*Dakota.*—Yankton: an ice gorge formed on the 20th, causing the Missouri River to overflow its banks, inundating the entire district between Sioux City and Elk Point. Hundreds of acres of farms were submerged from one to fifteen feet. The railroad bed in many places was entirely washed away, and considerable loss to live stock reported. The gorge held until the 25th.

*Mandan, Morton county:* an ice gorge formed in the river on the 26th, causing a rapid rise in the water, and flooding the entire lower part of the city.

*Nebraska.*—Meade, Saunders county: a freshet occurred in the Platte River on the 24th, breaking the ice, overflowing the banks, destroying the railroad bridge, and doing other damage.

*Yutan, Saunders county:* the Platte River overflowed its banks on the 17th and 18th, submerging the bottom lands above and below this place, the railroad track on both sides of the river for several miles was washed away; a few spans of the railroad bridge were also carried away.

*Genoa, Platte county:* the ice in the upper Loupe river commenced to break on the 16th; after the break ice-dams formed, causing the river to overflow on the 17th, flooding the old-town section of the city of Columbus. Bridges over the Loupe and Platte rivers were almost entirely destroyed, together with ten spans of the railroad bridge near the same city.

*Wisconsin.*—Milwaukee: the heavy rains of the 19-20th, together with melting snow and ice, caused the Menomonee and Milwaukee Rivers to overflow their banks on the 20th, doing considerable damage in the city and suburbs. The high water caused the sewers to back up, flooding a number of cellars and damaging their contents, especially among the business houses in the lower portion of the city, along the river front.

*New York.*—Troy, Rensselaer county: owing to the heavy rains from the 19th to 21st the Mohawk and Hudson rivers became greatly swollen, and at 10 p. m. of the 21st were within two feet of the great flood of last month. Serious land slides occurred on the Hudson River Railroad and in the southern part of the city; railroad traffic was suspended between this city and Albany.

*Albany:* the Hudson River rose rapidly during the morning of the 22d, and a freshet of eleven feet prevailed, overflowing the docks.

The excessive and unusual rainfall throughout the Southern States at the close of the month produced floods in all the rivers, causing the loss of many lives and an enormous destruction of property. In anticipation of these freshets the following warnings were issued by the Signal Service:

WASHINGTON CITY, March 30, 1886—10 a. m.

Continuous rains have fallen in the Southern States during the past few days, and will cause a rapid rise in the rivers, producing floods.

HAZEN.

At 3 p. m. the forecast was:

All rivers will generally rise in the Southern States, and freshets will occur.

HAZEN.

An effort was made to inform the public of the unusual rainfall and probable freshets, and the wisdom of these warnings was fully justified by the succeeding reports.

The following reports will serve to illustrate the destructive effect of these floods, which continued into the month of April, and they will be further described in the next REVIEW:

**Virginia.**—Lynchburg: incessant rains for several days caused a freshet in the James River and its tributaries; at 11.45 p. m. of the 30th the water had reached a height of twenty-four feet above low-water mark, being the highest since the disastrous flood of 1877. Great damage is reported along the banks of the river; several bridges were carried away, railroad tracks submerged, and traffic interrupted.

Variety Mills, Nelson county: disastrous floods followed the heavy rainfall of the last days of the month; the Tye and James Rivers were higher than at any time since the unprecedented flood of November 24, 1877. The Richmond and Allegheny Railroad was seriously damaged by the overflow in this county and elsewhere.

**Georgia.**—Augusta: a rapid rise in the Savannah River, causing it to overflow its banks, occurred on the 30th, the water reaching a height of 30.8 feet on the 31st and was still rising. Traffic was interrupted and railroads and mills compelled to suspend operations.

West Point, Troup county: the Chattahoochee River rose during the night of the 30th, flooding the town, carrying away the railroad bridge, and causing a loss of \$100,000 to property.

Columbus, Muscogee county: the Chattahoochee River was higher than ever before known on the 30th. The low country farms were damaged many thousand dollars, and the river was rising at the rate of six inches an hour.

Rome, Floyd county: the flood in the Coosa River submerged this city on the 30th, causing the inhabitants to seek the hill tops for safety.

**Alabama.**—Montgomery: owing to the heavy rains, a rapid rise occurred in the Alabama River on the 30th, and on the 31st the river had reached the highest point ever known, covering the Union depot railroad track to the depth of eleven inches. Trains were delayed in every direction, and considerable amount of damage done.

Tuscaloosa, Tuscaloosa county: the continuous rains for the forty-eight hours ending on the 30th caused the greatest flood in the Warrior River in fifty years, and from the present outlook the destruction of property and life will be enormous. During the evening of the 30th the river marked sixty-three feet above low-water mark and was still rising. The village of Northport, opposite this place, was flooded and the inhabitants compelled to vacate; below this place hundreds of negroes were cut off without boats and compelled to take to the top of their cabins for safety. Thousands of cattle were caught in the swamps and drowned. Reports from the surrounding country state that bridges and mills have been swept away.

Greensborough, Hale county: the rain storm from 4.30 p. m. of the 28th to 4 a. m. of the 31st was unparalleled, and produced destructive freshets in all streams at the close of the month. The Warrior River, ten miles west of this place, was three feet higher than ever known before; country bridges over numerous creeks were washed away or badly damaged, and railroad traffic between Selma and Tuscaloosa interrupted for five days.

Wetumpka, Elmore county: the bridge across the Coosa River at this place was washed away on the 30th.

Prattville, Autauga county: the freshet undermined a cotton factory, which fell in, causing a loss of \$85,000. Two hundred laborers were thrown out of employment.

**North Carolina.**—Chapel Hill, Orange county: a rapid rise occurred in the Roanoke River on the 31st, which overflowed its banks.

**Kentucky.**—Lexington, Fayette county: North River was eight feet higher than ever known on the 31st, and was still rising.

**Tennessee.**—Chattanooga: the river rose 13.5 feet during the twenty-four hours ending 2 p. m. of the 30th, and at 6.30 p. m. of the 31st had reached the height of forty-three feet, ten feet above the danger-line, and was rapidly rising.

Knoxville: the river and all tributary streams were flooded on the 31st, and considerable damage reported. The stage of water at 2 p. m. was 29.5 feet, showing a rise of 16.7 feet during the preceding twenty-four hours.

Sweetwater, Monroe county: at 1 a. m. of the 31st heavy rain was falling and no signs of abatement. The entire lower portion of the town was submerged, and nearly one hundred people rendered homeless.

Loudon, Loudon county: at 9 p. m. of the 31st the river was twenty-three feet and rising at the rate of ten inches per hour; land slides had occurred on the Loudon bluff, and families were driven from their homes on account of the high water.

Nashville: at 2 p. m. of the 31st the river had reached a height of 38.2 feet, and was rising at the rate of two inches per hour. Fears were entertained of a dangerous overflow.

#### HIGH TIDES.

New River Inlet, North Carolina, 17th.  
Fort Macon, North Carolina, 18th, 20th.  
Cedar Keys, Florida, 20th, 21st.  
New Haven, Connecticut, 21st.  
Eastport, Maine, 23d, 25th.

#### LOW TIDES.

The "New York Herald" of March 4, 1886, states:

The tides in all the bays along the south coast of Long Island have during the past few days been lower than for forty years. Large areas of oyster beds have been left uncovered by water for several hours at a time, and the oysters and clams have been frozen and killed. Many oystermen of Mecox, Shinnecock, Peconic, and Great South bays are heavy losers.

Low tides were also reported from—

Philadelphia, Pennsylvania, 1st, 2d.

New River Inlet, North Carolina, 2d, 3d.

#### VERIFICATIONS.

##### INDICATIONS.

The detailed comparison of the tri-daily indications for districts east of the Rocky Mountains during March, 1886, with the telegraphic reports for the succeeding thirty-two hours, shows the general average percentage of verifications to be 75.95 per cent. The percentages for the four elements are: Weather, 78.05; direction of the wind, 75.65; temperature, 73.46; barometer, 84.67 per cent. By geographical districts, they are: For New England, 77.02; middle Atlantic states, 77.12; south Atlantic states, 74.48; eastern Gulf states, 79.03; western Gulf states, 76.79; lower lake region, 74.04; upper lake region, 75.62; Ohio Valley and Tennessee, 76.25; upper Mississippi valley, 74.56; Missouri Valley, 74.65. There were nine omissions to predict, out of 2,865, or 0.31 per cent. Of the 2,856 predictions that have been made, one hundred and thirty-eight, or 4.83 per cent., are considered to have entirely failed; one hundred and eighty-five, or 6.48 per cent., were one-fourth verified; five hundred and twenty-seven, or 18.45 per cent., were one-half verified; five hundred and eighty-six, or 20.52 per cent., were three-fourths verified; 1,420, or 49.72 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

The percentages of verifications of special predictions for certain localities are, as follows:

Omaha, Nebraska (twenty-seven days), 82.41; Arkansas (twenty-seven days), 84.72; Baltimore, Maryland (twenty-seven days), 74.07; Washington City, 79.44; Portland, Maine, 69.35; Boston, Massachusetts (thirty days), 78.25; Albany, New York, 74.60; Pittsburg, Pennsylvania, 80.65; Erie, Pennsylvania, 69.76; Lynchburg, Virginia, 78.23; Cincinnati, Ohio, 66.13; Louisville, Kentucky, 70.97; Columbus, Ohio, 67.34; Cleveland, Ohio, 66.94; Lamar, Missouri, 71.37; Oswego, New York, 72.58; Rochester, New York, 79.44; Buffalo, New York, 75.81; Indianapolis, Indiana, 74.19; Detroit, Michigan, 78.23; Toledo, Ohio, 76.61; Sandusky, Ohio, 75.81; Cairo, Illinois, 75.81; Saint Louis, Missouri, 64.52; Saint Paul, Minnesota, 64.52; Iowa, 78.63; Milwaukee, Wisconsin, 76.21; Chicago, Illinois, 73.79; Memphis, Tennessee, 79.03; Tennessee, 70.56; Shreveport, Louisiana, 71.77; Georgia, 71.77; northern Florida, 80.24; New York City, 77.02; Philadelphia, Pennsylvania, 75.00; Colorado, 66.53.

#### CAUTIONARY SIGNALS.

During March, 1886, eighty-three cautionary signals were ordered. Of these, seventy-two, or 86.07 per cent., were justified by winds of twenty-five miles or more per hour at or within one hundred miles of the station. Seventy-nine cautionary off-shore signals were ordered, of which number, sixty-five, or 82.28 per cent., were fully justified, both as to direction and velocity; seventy-eight, or 98.73 per cent., were justified as to direction; and sixty-five, or 82.28 per cent., were justified as to velocity. One hundred and sixty-two signals of all kinds were ordered, one hundred and thirty-seven, or 84.57 per cent., being fully justified. These do not include signals ordered at display stations where the velocity of the wind is only estimated. Of the above cautionary off-shore signals, thirty-seven were changed from cautionary. Seven signals were ordered late. In seventy-four cases, winds of twenty-five miles or more per hour were reported for which no signals were ordered.

#### COLD-WAVE SIGNALS.

During March, 1886, seventy-nine cold-wave signals were ordered, of which number, fifty-nine, or 77.22 per cent., were justified.